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TITLE RELEVANCE OF INTERNATIONAL RESEARCH FACILITIES TO INTERNATIONAL STABILITY*

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Relevance of International Research Facilities to International Stability*

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to International Stability

I. Introduction: It is my pleasure to bring you greetings and good wishes from your sister society in America. The Twentieth Century, it can be argued, was the cradle of a triumvirate modern science, the hope for a quantum jump in the quality of life and the fear that the resilience and integrity of our planet may come to an inglorious end, perhaps even a fiery one.

Humanity, in simplest terms, is faced with only two problems: how to live in harmony with itself and how to live in harmony with nature. Cooperative endeavors, in general, and international scientific facilities in particular, have contributed to the mangement of both problems. They can, and must, in my opinion, do much more in each domain.

II. Major War - No Longer a Rational Option

Precisely 45 years ago, while a graduate student at Penn State University, I was recruited by Dr. Trytten, President Roosevelt's chief recruiter of scientists for the war effort, to join the so-called Manhattan Project, in the mountains of New Mexico. After arriving there I was told about the project and assigned to work on the use of chemical energy to assemble Pu (of which we had none, at that time) under conditions which would generate a large energy release. The purpose of the project was to build an atomic bomb which, it was expected, would end the war, first in Europe and then in Asia. The European war ended before nuclear weaponry became available, but not so the war in Asia, where the power and horror and devastation of nuclear weaponry was demonstrated; and those were quite crude weapons by today's standards. Fission weapons were followed by thermonuclear

ones and then by composites, each more devastating than the previous one. Slowly, almost imperceptibly, it began to enter the consciousness of mankind that, finally, major war cannot be a rational option for governments and for the people they serve.

Nonetheless, nuclear weapons will not go away certainly not the knowledge of how to produce them or the materials from which they are manufactured. It also appears that these weapons have represented a powerful deterrent, especially for the superpowers, to avoid actions which have a significant probability of escalating to all-out war but that came uncomfortably close, several decades ago, and on several occasions. It is, however, a fact that the last 40-years represent the longest time in modern history, a period dating back 350 years, that we have not seen a war involving the major world powers. Our 40 year preoccupation (and properly so) with the dangers presented by large nuclear arsenals has not been in vain. Although "deterrence" can never be fail-safe, I personally believe that premediated nuclear war is no longer a significant possibility. I also agree with those who argue that, during the next 10 years, we shall see the spectre of chemical and biological warfare garner the same kind of concern which we have devoted to the possibility of nuclear war because chemical and biological warfare have the possibility of being just as horrible and as global as nuclear warfare. In addition such weapons are far less expensive to produce and far easier to conceal. Nonetheless I am optimistic about the prospects for establishing control over biological and chemical weaponry, as well as over nuclear weapons. The reason for my optimism is that there is no viable alternative on the one hand; and because the world is rapidly becoming aware of a global, common danger of vast proportions not as acute as the mass destruction which would result almost instantaneously from full scale

nuclear war and soon chenical and biological warfare, bu' equally as deadly to most living things in the long run. This common global danger can be identified as environmental degradation, which is growing apace with population and as non-renewable resources are depleted on an exponential scale.

Also, the instabilities generated by islands of affluence in a sea of despair are becoming increasingly apparent. Whereas the present century has been characterized by the desire and achievement of independence for nations and peoples, the next century will need to see much greater emphasis on interdependence and on international cooperation and collaboration on a scale never before envisioned. Whether we anticipated it or not, whether we planned it or not, international scientific facilities have shown how to achieve wide-scale cooperation. Such facilities have mainly served the intellectual domain and this will, of course, continue to be fundamental to technological progress. But future international facilities will also have the requirement to serve the practical domain, and, in particular, to invent and evaluate new technologies that can contribute to international security, in its broadest context, and for all people. We should continually remind ourselves of the saying that "we have not inherited this planet from our ancestors, we are borrowing it from our children."

III. International Security

There is, fortunately, a growing realization that the security of any nation is inextricably coupled to the security of all nations. Most of the elements of national security are not substantially different from those of international stability. These include: (Transparency

1)

Agricultural Security

Environmental Security

Energy Security

Economic Security and, of course,

Physical Security

These five securities are not only international, they are also interdependent.

Fortunately, attitudes in both the US and the USSR, in NATO countries and in Warsaw Pact countries, are dramatically different, in a positive way, from what they were only a decade ago. Confrontation, as a remedy for disagreements, was tried for four decades. Some will argue that it served a purpose; few will argue that the world in general, and the superpowers in particular, can afford to rely on this approach, economically, or ethically or militarily. There is a growing willingness to give cooperation a chance. Early this year the Wall Street Journal reported the results of a comprehensive survey conducted as a bipartisan venture by four major polling organizations. The results are fascinating and hopeful. For example, 56% of those surveyed now believe that the US economy is a greater threat to national security than are military adversaries. When asked what they perceive to be the greatest national security problem in the US, the reply was "drug trafficking." In order of importance the US public wants its government to: (Transparency II)

1. Deal effectively with the drug problem;
2. Reduce the trade deficit and improve competitiveness in the market place;
3. Actively seek ways to cooperate with the USSR not only in Arms Control;
4. Spend less on the defense of other nations;

5. Hold defense spending at constant levels, but reduce waste;

For the purpose of our discussion today, item 3 is of paramount interest. International scientific facilities have been a powerful vehicle for promoting international cooperation.

IV. International Physics Facilities

When one thinks of international physics facilities, CERN stands out as a shining example of what such facilities might look like and what they can accomplish.

I had my last extended discussion with I. I. Rabi about three years before he passed away. I had decided to step down as Director of LAMPF and devote some years to arms-control-related issues. With the possible exception of Niels Bohr, I believe that Rabi was the wisest person I ever had the privilege of meeting. On this occasion we talked about what it will take to achieve a world devoid of a significant probability of major war. His conviction was that only when the inhabitants of this earth are overwhelmingly convinced that societal goals and ambitions cannot be achieved through armed conflict, only then will the scourge of war be banished. And then he reminded me of why he worked so hard to get CERN established. It was not because of the great science that the facility could produce or the technologies it would spawn or the economic activity it would engender. It was because he believed that only such major cooperative activities would catalyze production of the environment necessary for solving problems without resort to violence and destruction. I believe he was right, as usual. I know of no one who believes that there is a danger of warfare among the nations that are responsible for CERN. This is not to imply that CERN is the only reason for this belief, but CERN has helped immensely.

Not quite 20 years after the second World War, I was asked to serve on a government com

mission which was the first, from the US, to visit nuclear facilities in the USSR. I remember visiting the Kurchatov Institute where the accelerator facilities and the instrumentation matched very well what we had at Los Alamos. I was told that Professor Kurchatov, after the war, persuaded Stalin to build a basic nuclear research capability second to none so that it could serve as a bridge to the west. I was much impressed by this story.

The Joint Institute for Nuclear Research in Dubna has served a similar purpose. Along the path trodden by CERN followed Fermilab. Its purposes had less to do with the issue of world peace than they did with the issues of national prestige, advancement of science for its own sake as a great intellectural endeavor, development of technology, and industrial competitiveness. However, Fermilab has evolved into an effective vehicle for international cooperation. It was responsible, at least in part, for the establishment of the US/USSR Joint Coordinating Committee for the Fundamental Properties of Matter. This Committee has been operating, without interruption, for more than a dozen years, and with impressive accomplishments. We have been meeting one year in the USSR and the next year in the USA to agree upon collaborations and exchanges in particle and nuclear physics mainly, but also in condensed matter physics and in cosmology. From a rather painful start, when it was necessary to translate the meeting proceedings from one language to another and back again before signatures were affixed, the meetings are now conducted in an easy, informal atmosphere with no evidence of mistrust on either side.

There are, today, a large number of facilities which serve an international clientele. There are major ones in Japan, Germany, France, Italy, Canada, and elsewhere.

But the facility I know most about is LAMPF. LAMPF construction was started in 1968

and completed four years later. It was approved by the US Congress as an open facility, even though it was situated on the premises of one of the two nuclear-weapons-design laboratories in the country. Through the years LAMPF has served as a base for thousands of scientists from more than a score of countries. The degree to which it has contributed to relaxation of international tensions is not quantifiable. However, even during the coldest part of the cold war, there were visits to LAMPF by Soviet Scientists and also return visits by US scientists. I am pleased to tell you that the present Director of LAMPF, Gerry Garvey, is enthusiastically continuing the tradition of LAMPF as an international Lab. At the present time he is involved in a major experiment at a cosmic-ray facility in the Caucasus. A Soviet and US team is about to measure the solar-eutrino flux at very low energies.

Two anecdotes which are illustrative of the way international facilities can have a bearing on international relations may be worth relating. Soon after Gorbachev became General Secretary of the Communist party, I visited the meson factory site at Troitsk. I started my talk by observing that nothing we do in science will be helpful to humanity unless our two countries learn, rather soon, to live in better harmony with one another. I expected the usual silence which had traditionally followed such a political remark. I was surprised by the enthusiastic applause. I relayed this incident to Senator Pete Domenici and later heard that this anecdote made its way all the way up to the National Security Council and the President.

The second anecdote is perhaps even more dramatic. About eight years ago Mary and I were invited to spend some weeks in the Peoples Republic of China. Near the end of our

visit, we learned that Vice Premier Fang Yi would like to see us in his palatial office in the Forbidden City. The meeting was delightful and lasted far longer than we expected. Towards the end, the Vice Premier invited me to suggest how the PRC could accelerate its efforts to catch up with the West in science and technology. I suggested that he consider identifying, each year, some hundreds of the most creative, most innovative young scientists and engineers and sending them to centers of excellence, not for a few weeks or months, but for one or even two years, so that they could immerse themselves not only in the frontiers of science and technology, but in the environment which is conducive to the flourishing of science and derivative technologies. His reply was instant: "Very good idea, Professor Rosen, will you accept some of these at LAMPF?" After explaining that there was a 21-day limit on visits to LAMPF, I told him that if he would nominate some scientists whom we know by their reputation, I would try to get that regulation altered. He did and I did, although it took one year to accomplish. The first long-term visitor to LAMPF was Professor Sun Kuxun, who is now Director of The Institute for Atomic Energy. Every year since then we have had long-term visitors from the Peoples Republic of China and they are a joy to have among us.

One cannot quantify the extent to which this kind of initiative reduces unwarranted fears, decreases tensions and improves the climate for international relations, but it certainly helps.[1]

(1) My colleague, Dr. John C. Allred, puts it this way,"that it helps greatly is clear to all of us who have experienced these scientific interchanges. Scientific discussion is a neutral ground upon which what matters is not race or accent or color of skin. What does matter is the search for scientific truth done logically and with mutual good faith and trust. I believe these elements, good faith and trust, grow in scientific collaborations to embrace other facets of the lives of scientists of all nations. Whatever the mechanism, interactive scientific collaboration is a powerful force for confidence-building among nations."

V. New Initiatives

I have devoted the last three years trying to understand a variety of arms- control-related issues. I certainly applaud past and present efforts to decelerate the arms race, to seek verifiable ways to transform offensive to defensive postures, and to reduce the enormous stockpiles of weapons of mass destruction, and also conventional weapons, while maintaining stability. To me, arms control is any activity that reduces the probability of war without sacrificing fundamental values, including freedom from fear and freedom from hunger. I have, however, become convinced that weapons-accounting procedures, alone, no matter how verifiable, will be inadequate to achieve the political, social, and military environment necessary for a peaceful world. It will certainly not address major requirements of international security, especially those related to energy and the environment. It therefore appears to me that the time has come to dramatically expand international scientific facilities so as to stimulate international cooperation on those major global problems which cannot be solved unilaterally or even bilaterally.

International CERN-type laboratories devoted to energy and the environment appear to be not only desirable, but also necessary to serve the twin goals of improving the psychological environment for arms reductions and the physical enviroment for life on this planet. Without such cooperation the environmental situation can only continue its accelerating deterioration, until it becomes irreversible.

How then does one achieve cooperation beyond what we have at present. One small step is being attempted next summer in Santa Fe, NM. The University of California is sponsoring, and LANL is hosting, an international meeting entitled Conference on Technology-Based

Confidence Building. The topical agenda is shown in transparencies III and IV. The goals of the Conference are to focus attention on major global concerns and how they may be alleviated, and also to encourage cooperative activities towards addressing these concerns and simultaneously improving international security through increased communication and relaxation of tensions.

Another avenue is to increase people exchanges on a grand scale. This could be done by utilizing educational institutions that are only partiably engaged during the summer months.

VI. Responsibility of the Scientific Community in Matters of International Security

No less a person than Mikhail Gorbachev is on record as recognizing that the security of one nation cannot be achieved by making other nations insecure. He has, as no Soviet Leader before him, espoused the philosophy that national security is strongly coupled to international security. What is the responsibility of the scientific community in achieving international security? We, of course, have the same basic responsibility to work for peace and justice and freedom as does any other citizen. But, in my opinion, we have additional responsibilities as scientists. Of course, we must try to facilitate the thoughtful use of science and technology to improve the condition of humanity. But I agree with those who argue that we must do more to foster a peaceful world and to educate the people of this planet to the opportunities presented by science and also to the dangers of population growth, of escalating insults to the environment, and of the depletion of the earth's resources.

As the world continues to increase its dependence on technology, it is essential that the world's people increase their literacy in science and technology. The scientific community has a heavy responsibility to help make this happen. International scientific facilities provide a vehile for this endeavor.

In front of the US National Academy of Science, there is a bronze bust of Albert Einstein. Engraved on the marble base is the following quotation: "The right to search for truth implies also a duty. One must not conceal any part of what one has recognized to be true." Dr. Vannevar Bush, Director of Scientific Manpower during WWII authored the book *Science, the Endless Frontier*. He quotes as follows from the closing paragraph of his final report to President Roosevelt "on the wisdom with which we bring science to bear against the problems of the coming years depends in large measure our future as a nation." That statement is even more relevant today. I would only replace "our nation" with "our world."

VII. Conclusions:

International Facilities have played an important part in expanding and keeping open a dialogue between east and west The advent of *glasnost* has dramatically reduced inhibitions on communications and opened new opportunities for international facilities to facilitate the understanding and appreciation of common goals and common threats. This is accomplished through frank discussions in which real problems are identified and assessed while fictitious ones are laid to rest.

Concerns about energy, the environment, economic security, raw materials availability, etc., require more effective international cooperation. Scientific facilities have provided a

training ground for such joint enterprises, in both the technical and sociological spheres. Finally, international science facilities can help to bridge the chasm between the experts and the non-technical community, because their support requires describing the purposes and goals and hopes of science to the general public, which must bear the burden of their support just as it enjoys the fruits of their progress.

It therefore appears that we should now consider greatly increasing our investment in international facilities to specifically address not only basic research but also practical issues, such as environmental pollution, energy production, resources depletion, weather modification, defense against terrorism, space exploration, and, of course, agricultural technology. A final example: it appears that far too little attention has been given to the role of the oceans in the ecology of our planet. If we define coastal areas as 200 miles in depth, we see that well over half of the world' s population resides in just those areas. Global temperature changes of not many degrees have the potential for producing havoc. Is there a more important long term goal than to understand that issue? Does it not merit a major international initiative? Even a major international facility?